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NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

A FRAMEWORK FOR MATCHING USER
NEEDS TO AN OPTIMAL LEVEL OF
OFFICE AUTOMATION

by

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June 1988

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88 12

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b RESTRICTIVE MARKINGS

2a. SECURITY CLASSIFICATION AUTHORITY	3 DISTRIBUTION / AVAILABILITY OF REPORT
2b. DECLASSIFICATION / DOWNGRADING SCHEDULE	Approved for public release; distribution is unlimited

4. PERFORMING ORGANIZATION REPORT NUMBER(S)	5 MONITORING ORGANIZATION REPORT NUMBER(S)

6a. NAME OF PERFORMING ORGANIZATION Naval Postgraduate School	6b OFFICE SYMBOL (If applicable) 62	7a. NAME OF MONITORING ORGANIZATION Naval Postgraduate School

6c. ADDRESS (City, State, and ZIP Code) Monterey, California 93943-5000	7b. ADDRESS (City, State, and ZIP Code) Monterey, California 93943-5000

8a. NAME OF FUNDING / SPONSORING ORGANIZATION	8b OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER

8c. ADDRESS (City, State, and ZIP Code)	10. SOURCE OF FUNDING NUMBERS			
	PROGRAM ELEMENT NO	PROJECT NO	TASK NO	WORK UNIT ACCESSION NO

11. TITLE (Include Security Classification) A FRAMEWORK FOR MATCHING USER NEEDS TO AN OPTIMAL LEVEL OF OFFICE AUTOMATION

12 PERSONAL AUTHOR(S)
VAN RUITENBEEK, Arnold John

13a. TYPE OF REPORT Master's Thesis	13b TIME COVERED FROM ____ TO ____	14 DATE OF REPORT (Year, Month, Day) 1988 June	15 PAGE COUNT 78

16. SUPPLEMENTARY NOTATION The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government

17.	COSATI CODES		18 SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Office automation, strategy, organizational per-
			formance, equipment selection, office environment

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

This thesis introduces the concept of determining an organization's optimal office automation strategy by investigating seven characteristics commonly used by office managers to describe their organizations.

These organization characteristics are size, structure, geographic dispersion, task, technology, environment, and employee skill. These seven characteristics form the input into an office automation framework which mathematically determines which of three office automation strategies is best for a particular organization. These three strategy levels are called low level operational control, mid level management control, and high level strategic control. The newly determined office automation strategy can in turn be used to choose appropriate systems analysis methods for the organization, and for the follow-on purchase and integration of an office automation system. (KR)

20. DISTRIBUTION / AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED

22a. NAME OF RESPONSIBLE INDIVIDUAL T.R. Sivasankaran	22b TELEPHONE (Include Area Code) 408-646-2637	22c OFFICE SYMBOL 54Sj

DD FORM 1473, 84 MAR
83 APR edition may be used until exhausted
All other editions are obsolete

SECURITY CLASSIFICATION OF THIS PAGE
☆ U.S. Government Printing Office: 1986—606-243

UNCLASSIFIED

A Framework For Matching User Needs
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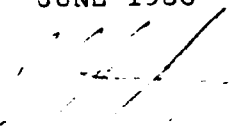B.S., University of California, Davis, 1977

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN TELECOMMUNICATIONS SYSTEMS MANAGEMENT
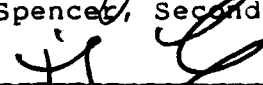
from the

NAVAL POSTGRADUATE SCHOOL
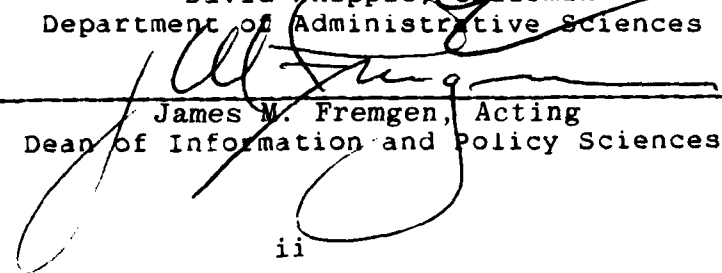JUNE 1988

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ABSTRACT

This thesis introduces the concept of determining an organization's optimal office automation strategy by investigating seven characteristics commonly used by office managers to describe their organizations.

These organization characteristics are size, structure, geographic dispersion, task, technology, environment and employee skill. These seven characteristics form the input into an office automation framework which mathematically determines which of three office automation strategies is best for a particular organization. These three strategy levels are called low-level operational control, mid-level management control, and high-level strategic control. The newly determined office automation strategy can in turn be used to choose appropriate systems analysis methods for the organization and for the follow-on purchase and integration of an office automation system.

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I. INTRODUCTION

Office automation (OA) is the application of data processing and telecommunications technologies to the task of managing business information. The word "office" in office automation is often associated with a room filled with desks, telephones, and file cabinets. An office, however, can also take on many other forms; for example people whose occupation involve extensive traveling may use a motel room or the front seat of their car for an office. For the purposes of this thesis an office is "any place where managerial, professional, and clerical workers are engaged primarily in handling business information." (Barcomb, 1981, pp. 1)

The word "automation" is defined as the process of "substituting some device or machine for a human activity" (Parsons, 1985, pp. 99). The word automation originated in the automobile manufacturing industry in the 1930's as an easier to pronounce substitute for the term automatization.

A. A FRAMEWORK: THE STARTING POINT

Office managers now face a proliferation of computers that increases both the scope and the complexity of the technological choices through which the manager can perform office tasks more efficiently. In the absence of a general

framework, managers will find it difficult to determine the degree of office automation that would ideally suit their organization.

This thesis is designed to help office managers choose an office automation strategy which is best suited to their needs by providing them with a reference framework which optimizes their office automation choices using a process outlined in this thesis. This process takes into account the characteristics of the organization investigating office automation technologies and determines which level of office automation is most suitable for the organization.

B. THE COST OF USING PAPER IN OFFICE ENVIRONMENTS

Often the large "hard dollar" cost of starting up and operating an office automation system is of great concern to office managers and their budget approving supervisors. Although this concern has its rightful place, an office manager should note the existing costs associated with their current procedures for the production and storage of paper records.

> In 1977 the annual cost to maintain document files was nearly 15 cents per page, including labor, depreciation on file cabinets, and cost of floor space; by 1980 that figure is estimated to have risen to almost 20 cents per page....The cost to complete, and store for five years, a full file cabinet of forms is estimated to cost over $42,000 in 1980 dollars. (Barcomb, 1984, pp. 9-10)

Office automation systems can electronically replace many of these paper-based transactions, and thereby replace

the paper documents created during the manual transaction process. The replacement of expensive paper based systems can offset a portion of an automated system's cost. However, the main point here is not that office automation systems can be operated at less cost that manual transaction systems but that operating exclusively with paper records is not as inexpensive as it may first appear.

C. PERSPECTIVES IN OFFICE AUTOMATION DECISION MAKING

Office managers, who supervise offices in which the primary means of communication is conducted via the routing of paper, are becoming concerned about their decreased competitive stature attributable to their inability to retrieve needed information in a timely and accurate fashion.

Many managers feel they are losing control over the very information that is central to the viability of their organizations. Other managers, who are directed to meet increased productivity mandates, are faced with increased work loads without commensurate increases in personnel resources. Still other managers are attempting to complete activities within apparently unrealistic deadlines. Office automation is specifically directed at these management concerns and others.

Managers look to office automation for improved office productivity in their work place. Six common office

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automaticn effectiveness measures are often cited by managers as reasons for automating activities which were previously done manually. These six reasons are (SENN, 1984, pp. 38):

1. Faster transaction processing

2. Better accuracy and improved consistency

3. Faster information retrieval

4. Integration of business activities

5. Reduced cost

6. Better security

However, the use of these six office automation effectiveness measures, individually or collectively, is short sighted and narrow in scope. A more realistic approach is presented in the following text:

> The real objective of office automation is to improve the performance of an organization's business operations....
>
> The artifacts of office operation are not ends in themselves, but exist only to enable the office to accomplish its business mission....Most offices, as opposed to factories, do not have products of intrinsic economic value. While producing twice as many automobiles for the same amount of resource is an undeniable improvement in productivity, producing twice as many documents (or having twice as many communications) is not an inherently valuable change....
>
> Increasing the efficiency with which office tasks are performed is only of interest if it yields an improvement in the realization of the business function that is the real mission of the office. The goal of office automation should be increased effectiveness of business operations, rather than increased efficiency in information handling. (Hammer, 1982, pp. 247-8)

Although the perspective above is a more useful one, it widens rather than closes the gap between a random

collection of OA equipment picked out of a vendor's catalog and an effective operational OA system. This thesis will help office managers bridge this gap by helping them determine which level of office automation best meets the needs of their particular organization.

The OA selection process is closely related to the implementation process, and the success of these two processes are very interdependent. For the benefit of the general reader, an introduction to the implementation of OA systems is provided in Appendix A.

II. A SYSTEMS PERSPECTIVE OF OFFICE ENVIRONMENTS

Office automation offers managers solutions to many of their office productivity problems. However, few of these productivity improvements will be realized by managers if they attempt to directly automate their inefficient manual information processing methods. To the contrary, these managers will operate just as poorly or worse. In addition to failing to achieve higher productivity levels, these managers will also have the added burden of paying for expensive office automation equipment, thereby still further reducing their overall cost/benefit productivity measure.

Conversely, being efficient within the limits of an all paper office does not guarantee a smooth transition to automation. Too often office managers treat office automation products, such as free standing computers or local area networks, as black boxes which are somehow intrinsically endowed with an understanding of their particular office and its specific functions. One of the largest misunderstandings non-users and new users have regarding office automation is assuming that an office manager's understanding of an office function is the equivalent of an office automation system correctly processing that function.

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Consequently, one of the most difficult tasks a manager faced with the prospect of automating his office has is "telling" his office automation equipment, and the vendor who supplied the equipment, how his particular office staff goes about attaining their goals, and how his office inter-relates with customers and other offices within his organization.

A careful review of the activities and information flow patterns of an office should be undertaken prior to automating these previously manual functions. This formal process of describing how information enters an organization, how it is used and how it affects the outputs of an organization is called systems analysis.

A systems analysis of an organization is a crucial step in the process of automating previously manual functions; it is also a crucial step in redesigning existing automated systems.

For large organizations a systems analysis is often conducted by a team of office automation consultants. A manager of a large organization rarely completes the systems analysis himself because it is unlikely that he has a thorough enough understanding of how his organization functions, how his information uses are integrated together, and how his staff interacts with activities external to his office. Insufficient time to devote to this task is another reason these managers do not complete the analysis

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themselves, although where feasible, it is to a manager's advantage to follow as closely as possible the systems analysis of his office. This familiarity with the analysis will increase his ability to critically evaluate the OA consultant's recommendations regarding modifications to his office procedures.

However, in smaller organizations the opposite may be true, consultants in this case are not the only means of developing a systems analysis. To the contrary, office managers may best be able to prepare themselves for the transition from manual to automated office processing by accurately and completely identifying their information flow patterns without outside system analysis assistance.

But as with the larger organizations noted earlier, the manager must first determine how much of his office should be automated. That determination must be made first or else time and money will likely be wasted analyzing office activities that do not justify being automated. The office manager needs a decision tool to help him determine what OA strategy best suits his organization. This decision tool is the reference framework discussed in the follow-on chapters of this thesis.

A. DIVERSITY IN OFFICE ENVIRONMENTS

Not all organizations are created equal in their characteristics, and therefore, no panacea in the form of a

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single all-purpose analysis can suffice for describing how information is used in all organizations. As an example, seven dual-answer questions are listed below to indicate the wide variety in business information environments:

Does the business in question:

1. Bill customers or accept cash only transactions?

2. Deliver goods at time of sale or later?

3. Record customer profiles or are no records kept?

4. Sell products at fixed or negotiated prices?

5. Sell or lease its products?

6. Record to whom products were sold or are no records kept?

7. Make products to order or are they selected from stock on hand?

These seven dual-answer questions can differentiate between many different types of internal business environments. These questions are not presented here to fully define an office's information flows, but are used here to illustrate the rich diversity found in the full spectrum of business activities. (Carlson, 1979, pp. 6)

Imagine how differently an independent single-site retail ice cream business would answer these seven questions and how different its information needs are in comparison to a 15 partner law firm. As a result, a systems analysis of these two businesses would reveal widely differing information flows and interactions, and hence their office automation needs would also be drastically different.

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B. A SYSTEMS VIEWPOINT

A systems analysis is most beneficial when it encompasses a broad view of office activities. The analysis should be conducted from a business perspective that takes in the operation, mission, and goals of the entire organization in which the automated office will be situated (Hammer, 1982, pp. 249). Only by understanding how an office is currently operating can a systems analysis identify potential improvements that can be brought to fruition through the introduction of automated methods.

> There is no substitute for coming to grips with the substance of the office's work....The focus of the plan should be the development of a strategy by which office systems can contribute to the improved operation of the company's business activities. The key, therefore, to success in planning and implementing office automation is a thorough understanding of the characteristics, activities, and needs of the organization. Planning for office automation should focus on the company, on its business strategies and processes, and on the problems and opportunities inherent in these. (Hammer, 1982, pp. 251-2)

Improvements gained through automation are centered around increasing various types of business performance measures, therefore the first step in the systems analysis is to identify these performance measures. No organization has a single performance measure nor are all measures of equal importance. Individual organizations, in response to their specific business environment must choose which performance measures are appropriate for them and weight these measures accordingly. Many of these performance

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measures can be grouped into four general categories, namely financial measures, quality measures, competitive measures, and organizational health measures.

1. Financial Measures

Financial measures are those performance characteristics which can be directly expressed in monetary terms. Common measures in this category include cost reductions in regard to existing and regularly reoccurring office activities and cost avoidance associated with the expense of new office activities and the increased cost of expanding existing office activities.

Specific examples of financial measures include organizational cash flow and return on investment.

2. Quality Measures

Quality measures relate to how well an organization conducts its operations. The speed at which an office activity takes place and hence the time it takes to complete the activity is a universal quality measure. Although the accuracy and consistency of office transactional processing, in some organizations, can be a more important quality measure then speed, as is the case with accounting and engineering applications.

Flexibility is another quality measure. Organizations operating in fast changing environments or who deal in custom products may place a heavier emphasis on

flexibility than organizations operating in a highly structured environment.

3. Competitive Measures

The third category is a grouping called competitive measures, these measures "relate to the performance of an organization in the context of the marketplace." (Hammer, 1982, pp. 250) The size of an organization, its market share, public image, and growth rate are intrinsic competitive measures.

Common external competitive measures are the stability of the external business environment, customer base fluctuations, innovation of competing organizations, and the price sensitivity of products or services provided by the organization.

4. Organizational Health Measures

Organizational health measures "indicate how well the unit is functioning as an organization, which in turn can have a major impact in its business performance." One of the most important of these is employee morale. Secondary measures in this category include absenteeism, turnover rates, and quality of life issues such as job content and advancement opportunities.

One of the first uses of office automation systems was word processing. This change in some instances was met with great user resistance due to the marked decrease in organizational health measures that accompanied the arrival

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of word processing. Many companies in an effort to efficiently use the new word processing equipment moved the secretaries into typing pools to keep the equipment in use to the fullest extent possible. This organizational change destroyed the working relationship that previously existed between managers and secretaries.

Two sharply negative results occurred as a result of losing this vital relationship. Managers who had secretaries personally reporting to them suffered a loss of status and loss of non-typing clerical support that their secretaries provided. Secondly, the secretaries found themselves in new jobs which had greatly reduced job satisfaction metrics and extremely limited advancement opportunities. Consequently, failure to take into account all the pertinent performance measures yielded a sub-optimal office automation solution in this situation. (Meyer, 1983, pp. 68)

C. QUANTIFICATION OF ORGANIZATIONAL PERFORMANCE METRICS

As noted in the previous paragraphs, not all benefits are measured in hard cost-saving dollars, this however, does not negate these value-added benefits.

> Although value-added benefits are generally more relevant to top management than cost savings, they are more difficult to measure objectively - in the same way that a manager's worth and performance are difficult to appraise. (Meyer, 1983, p. 66)

In an effort to complete a quality systems analysis, it should be kept in mind that it is more beneficial to

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"roughly measure significant benefits than to accurately measure trivia" (Meyer, 1983, pp. 66). On the other hand, if a certain benefit of an office automation system is not measurable or quantifiable then there is doubt the benefit ever existed. (Hammer, 1982, pp. 250)

D. NON-SYSTEMS ANALYSIS ISSUES

Office managers considering a new or expanded OA system should also concern themselves with additional considerations which are outside the context of this thesis. A brief discussion of these considerations can be found Appendix B.

E. OA STRATEGY STILL FOUND LACKING

Categorizing performance measures and quantizing these measures are necessary steps in determining an optimal OA system for an organization. However some type of OA strategy must be identified before hand to make this OA selection process efficient, thus better ensuring a beneficial and workable OA solution for the organization. A reference framework is presented in chapter four of this thesis which will assist office managers and others in determining the correct OA strategy for an organization.

III. A SURVEY OF SYSTEM ANALYSIS METHODOLOGIES

The previous chapter introduced the concept of viewing an organization from a system analysis perspective which relates the interaction of various organizational activities and determines their attendant performance measures.

There are many different types of systems analysis methods available to managers who plan on automating all or portions of their offices. This chapter will describe four methods that are in common usage and reviews the ability of each to identify an organization's optimal OA strategy.

A. BIAIT

Business Information Analysis and Integration Technique (BIAIT) is a system analysis method developed from research conducted by Donald C. Burnstine. The research began with a collection of 300 information handling questions. After reviewing the questions and their implications it was determined that seven of these questions could "uniquely and systematically characterize the way an organization uses information--independent of its size and independent of the product or services it provides." (Carlson, 1979, pp. 5)

Of the seven questions, answers to the first four describe the way the organization relates to its customers, and the answers to the remaining three questions describe the characteristics of the entity being ordered.

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To place these seven questions into perspective five definitions or ground rules evolved. The first concerns the notion of an "order". An order, in a BIAIT context, is anything that triggers a response from a supplier. It can be something as straight forward as a purchase order, or it can be as informal as a question received over the telephone.

The second ground rule states that the entity being ordered must be either "a thing, a space, or a skill." (Carlson, 1979, pp. 5) A thing, like a bolt, is applicable to a product oriented business, whereas a space, like a seat on an airplane going from New York to San Francisco, or a skill, like brain surgery, is more applicable to service oriented businesses.

The third ground rule concerns the perspective of the person conducting the analysis. Since the analysis is conducted for the business, all transactions should be viewed from the the perspective of the supplier rather than the customer.

The concept of a customer and supplier is broadly defined here to include transactions completely confined to the internal workings of the organization, such as engineering assigning a work order to production to manufacture a item for use by the organization's engineering staff.

The fourth rule allows businesses to process multiple types of orders each with differing characteristics, the seven BIAIT questions can therefore be answered differently for each type of order.

The last rule restricts answers to the seven questions to one of two answers for each question. The dual answer format yields a total of 14 answers which theoretically describes 128 (two to the seventh power) different business environments.

Furthermore, the BIAIT analysis can be conducted at multiple management levels within the organization. The analysis can occur at up to three different levels within the organization, these three levels are the Enterprise/Establishment level, the department level, and the occupation level. The seven BIAIT questions, each phrased at the three management levels, are illustrated in Table I.

Little imagination is needed to see parallels in information handling between different management levels within the organization. As an example consider the fourth BIAIT question concerning pricing. The difference is quite small between concept of fixed and negotiated prices for products sold by the organization in relation to the lower level BIAIT parallel of costed work orders and work orders based on standard rates. Both levels view the product/service as either a standard item or a custom ordered item.

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TABLE I.
BIAIT QUESTION TABLE

(Carlson, 1979, pp. 6)

Supplier Questions Organization Level	Billing?	Deliver Later?	Profile Customers	Negotiate Price?
Enterprise/ Establishment	bill or take cash	later or now	record previous orders from source or no profile	negotiate or fixed
Department	cost center or budget	plan work or fire call	record previous orders from source or no profile	costed work order or standard rate
Occupation	commis-sion or salary piece work or hourly wage	self-sched-uled or prior-ity set by others	record previous orders from source or no profile	costed work order or standard rate

Ordered Entity Questions	Rented?	Tracked?	Made to Order?
Organization level Enterprise/ Establishment	rented or sold	record who received or no record	made/assembled to order or from stock
Department	loaned or given	record who received or no record	assemble/create or provide from files
Occupation	loaned or given	record who received or no record	assemble/create or provide from files

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Using BIAIT analysis method at multiple levels within the organization allows the person doing the analysis, a consultant or the office manager himself, to build a generic information handling model of the office before any mention of OA equipment is made. The seven BIAIT questions become the outline for interviews held with various members of the office staff. The choice of who is interviewed depends on what level within the organization one is trying to model.

At the occupation level, interviewing the employee filling the job being modeled is an excellent starting point. In some cases, higher level supervisory personnel may be required to add answers to the seven basic questions when the employee is not familiar with all the types of orders he is required to process. Similar interviews with other appropriate members of the office staff, the office manager, and the office manager's supervisor are conducted to answer the seven BIAIT questions in the context of the two higher levels in the organization. This multi-level analysis also determines who in the organization creates a piece of data and it also identifies who the users of the information are once it's created.

Using a generic information handling model, built on the BIAIT analysis, a manager can form a statement of need on which OA vendors can demonstrate their equipment's capability to fill that office manager's need for product intensive information processing.

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By its very nature BIAIT system analysis tends to be a product oriented analysis, and conversely does not not give much weight to office activities not directly supporting the production of goods and services. Consequently a BIAIT analysis may not adequately address non-production oriented activities within the organization.

An OA strategy as determined by a BIAIT analysis will be almost exclusively transactionally oriented regardless of which OA strategy is optimal for the organization. A BIAIT analysis should only be considered as a follow up analysis when a transactional OA strategy is correctly identified as optimal via the reference framework discussed in chapter four of this thesis.

B.   CRITICAL SUCCESS FACTOR ANALYSIS

Another type of system analysis is called Critical Success Factor (CSF) analysis. CSF is based on interviews with managers regarding their goals and the success factors they feel are critical to the attainment of those goals. Therein defining the "significant information needs" required to measure possible organizational improvements regarding CSFs. Normally three to six factors are determined to be critical to the success of a manager. Since more than one manager is generally interviewed, multiple sets of CSFs are likely to occur. In many cases the analyst has to realize that different managers have

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different task assignments and different objectives. It is up to the person conducting the CSF analysis to combine conflicting manager CSFs into an overall organizational set of CSFs. Due to the sources of information used in CSF analysis, OA designs based on this type of analysis are heavily top-down structured. The needs of top management, as expressed in their CSF, are assigned more weight when determining the organization's overall CSF. (Rockart, 1979, pp. 84-5)

1. Financial CSFs

Critical Success factors originate from four basic categories. The first category revolves around the structure of the industry the organization is competing in. For-profit organizations have making a profit as one of their major critical success factors. Cash flow and price/earnings ratios are measures of the profit CSF and as such they become "significant information needs" of the organization. (Rockart, 1979, pp. 86)

2. Competitive Strategy CSFs

The second category is competitive strategy. Competitive strategy concerns factors such as low cost producers within the industry, distribution of resources among an organization's product line, the rate of new product development within the industry, and the organization's market niche defensibility. Industry position relates to how many competitors are in a particular

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market and the market share distribution among those competitors. (Rockart, 1979, pp. 86)

3. Environmental CSFs

The third CSF category is environmental factors. Many CSFs deal with conditions external to the organization. Availability of raw materials and government regulations are common examples of factors in this category. An environmental factor can be the primary CSF for managers in some industries. However, being external to the manager does not mean that the manager has no control over these factors or that he cannot monitor the variables which measure improvements in this CSF area. (Rockart, 1979, pp. 86)

4. Temporal CSFs

The fourth and last CSF category is temporal factors. These factors are short-term in duration and commonly surface in management by exception reporting systems. These factors have become CSFs because they are below an acceptability threshold and therefore critically impact the present operation of the organization. (Rockart, 1979, pp. 87)

OA systems designed to meet CSF management control needs "must be tailored to the specific industry in which the company operates and to the specific strategies that it has adopted;" furthermore, it must also record variables which monitor organizational improvements in relation to CSFs. (Rockart, 1979, pp. 86)

CSF analysis is beneficial because it helps managers focus on variables which affect their CSFs, therefore with this analysis method they derive the greatest organizational benefits from their analysis efforts. The emphasis of the CSF analysis is on identifying and measuring variables which affect the organization's CSFs, thereby defining the scope of information required by the organization. This definition of scope eliminates the cost of collecting excess information and reduces the information overload managers are often exposed to during a systems analysis. (Rockart, 1979, pp. 88)

Identification of CSFs also prevents organizations from building an OA system around the information that is easiest to collect rather than the significant information relevant to CSF areas. (Rockart, 1979, pp.88)

CSFs are often changing and consideration should be given to the flexibility of the OA system to meet organizational factors which were heretofore not considered critical, or to meet completely new CSFs occurring as a result of changes internal and external to the organization.

On the other hand, a properly completed CSF analysis may identify CSFs which are manager specific or temporal in nature and these CSFs should be weighed accordingly in the overall OA system for the organization. (Rockart, 1979, pp. 88)

A CSF analysis in itself does not identify the extent of OA required to assist top managers in the monitoring of their CSFs. An OA system purchased solely to monitor top management CSFs may fail due to the non-availability of the basic organizational data upon which top management CSFs are based. A framework must first be used to identify the organization's OA strategy, from that point an organization can better determine how OA can assist in monitoring the organizational variables which effect its CSFs.

C. BUSINESS SYSTEMS PLANNING

Business systems planning (BSP) was developed in 1975 by International Business Machines (IBM) to help organizations design an information systems plan that takes on the perspective of top management and is integrated into the overall business plan of the organization. The first two phases of BSP, identification and definition, comprise the systems analysis portion of the BSP study, and hence it is of interest to someone about to start a systems analysis of an organization.

BSP, unlike CSF analysis, takes a business-wide top management approach that is very broad in scope. BSP covers many functional areas of a business and attempts to integrate them into one view of the organization. From this one view of the organization, BSP defines the systems and

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subsystems necessary to meet the information needs of the organization and outlines the requirements for implementing these systems during later phases of the BSP. (Couger, 1982, pp. 237)

The first objective of the BSP identification phase is to "develop an overall understanding of the business" and determine how its data processing activities support the business. Inputs to this phase include the current organizational structure, profiles of the existing manual and automated informations systems, reports generated by the organization, and the results of previous systems analyses performed, if any. (Couger, 1982, pp. 247)

The second objective of this phase is to "identify a gross network of information systems that will support the business" and within this network determine which subsystems are most needed and/or have the highest payback possibilities. Lastly, the identification phase "develops an action plan" for the follow-on definition phase. (Couger, 1982, pp. 247)

"The objective of the definition phase is to develop a long-range information systems plan" that will ensure that "the business's information resources will be effectively used". This plan is based on the specific information needs of the business and is detailed enough to provide managers with guidance regarding who in the organization is responsible for what implementation activities along with how and when to do these activities. (Couger, 1982, pp. 279)

Specifically, the information systems plan should be a vehicle to facilitate communication between functional areas, and should provide top management with the information they need regarding their control of the present BSP phase and the follow-on phases. (Couger, 1982, pp. 280)

The value of BSP lies in the fact that it is top-down structured and bottom-up implemented. In the structure portion of BSP "top management involvement establishes organizational objectives and direction, as well as agreed-upon system priorities" and sets forth consistent data standards for the entire organization. Furthermore, the bottom-up implementation is "management and user oriented rather than data processing oriented." (Couger, 1982, pp. 239)

Using BSP analysis, a business develops "an assessment of future information systems needs based on business related impacts and priorities" but remains "relatively independent of the organization's structure" (Couger, 1982, pp. 239). From a systems perspective, BSP is "an evaluation of the effectiveness of current information systems" (Couger, 1982, pp. 239) that goes on to outline an information systems plan which sets implementation priorities based on organizational needs and early returns on OA investments. Thus it can be a powerful tool in the hands of a manager trying to determine his office automation requirements in the long run.

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The scope of BSP is very large and therefore the systems analysis in support of BSP will also be very large and costly. If managers had a reference framework that could quickly identify and therefore contain the scope of the systems analysis the BSP and other analysis could be more effectively conducted.

D. GENERIC DATALOGICAL ANALYSIS

Datalogical analysis views business information in a very microscopic way, rather than from the broad perspective taken in the analysis techniques discussed above.

OA systems, which appear to meet the needs of an office, normally have software incorporated into them that has the ability to store and handle the individual pieces of data used in that office. However, some caution in this area is appropriate.

During vendor demonstration of OA systems, office managers are strongly encouraged to ensure that their data characteristics are compatible with the OA system. As an example, if an office is presently using a manual record keeping system which is based on a nine character customer identification code (i.e., Social Security Number) then the OA system under consideration should have the ability to store at least a nine character customer code. If this is not the case, managers must consider the cost of converting the office data into a form compatible with the new OA

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system. This additional cost should not be confused with the unavoidable cost of inputing the data into the system during original start up. Similarly, if the office has a customer mailing list with overseas addresses then the OA system should be flexible enough to store those types of addresses, or a situation will exist where a sub-optimal OA system forces users to meet equipment requirements rather than the other way around.

Unfortunately this type of systems analysis does little to guide an organization toward its optimal OA strategy and suffers from the lack of a clearly definable end point. In this case a manager is never sure when enough analysis has been conducted or if the analysis previously conducted is of any benefit to the organization's optimal OA strategy.

E. SELECTING AN OA STRATEGY

Chapters two and three of this thesis discuss the concept of viewing an organization from a systems perspective, citing commonly used system analysis methodologies. However it can be noted that an effective systems analysis needs a goal in order to provide the information an office manager needs. A high quality system analysis may provide an office manager with a large amount of very accurate information regarding his organization's information flows, but this information may be of questionable valve when that office manager sits down to decides to what extent he will automate his office.

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Completing a systems analysis could be done more efficiently if the manager doing the analysis knew before hand what OA strategy best suited his organization. The next chapter of this thesis is designed to guide an office manager through the decision process that determines the optimal OA strategy for his or any other organization.

After an OA strategy has been selected then a follow-on system analysis could be more effectively focused on target information flows which could benefit from the newly identified OA strategy.

IV. A FRAMEWORK FOR OFFICE AUTOMATION STRATEGIES

Although management scientists have researched organizations in detail, there seldom have been studies undertaken to determine a general reference framework that is useful in selecting an optimal office automation strategy for an organization. Since management scientists have tended to emphasize the characteristics of the organization under consideration, a starting point in developing such a framework is to use those characteristics as a basis for office automation strategy distinction. Since organizations have many different characteristics to distinguish them from other organizations, it is quite evident that no one office automation strategy will suit all organizations.

Therefore a person tasked with determining which office automation strategy to pursue, must somehow decide which organizational characteristics he should consider. Then he must collect and organize these characteristics into some type of format from which he can determine the optimal office automation strategy for the organization.

This thesis presents a framework by which decision makers can determine the optimal OA strategy for a particular organization. A framework is defined as "a systematic set of relationships" or "a conceptual scheme, structure, or system" (Gove, 1961, p. 902).

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The framework presented here is a system in which inputs, in the form of selected organizational characteristics, are used to make a decision regarding the selection of the optimal office automation strategy for a particular organization.

A. ORGANIZATIONAL CHARACTERISTICS

As noted earlier, the optimal choice of office automation strategies is based on organizational characteristics. From the many characteristics which describe an organization's informational needs, seven characteristics were chosen as inputs for the office automation strategy framework. A list of these organizational characteristics are noted below:

- Size
- Structure
- Task
- Technology
- Employee Skills
- Environment
- Geographical Dispersion

These input characteristics are examined individually in the following sections of this thesis.

1. Size

From an informational point of view, the best metric for measuring the size of an organization is the number of employees on its payroll. (Miles, 1980, pp. 61-62).

Large organizations are not just small organizations on a larger scale. As organizations grow, certain areas in the organization grow at faster rates than others. The Birmingham Study conducted by the Aston Group in England observed that as organizations increase in size, a larger percentage of the organization is directed toward support activities, and conversely, a smaller percentage is directed toward primary production activities. As the *primary production workflow became a smaller percentage of* the organization's total activities, the impact of technological change in that proportionally smaller area also has a proportionally smaller impact on the total organization. (Miles, 1980, pp. 55-56)

In summary, the Birmingham Study discovered an inverse relationship between the size of a given organization and the extent to which specific production related technological changes can impinge upon the total organization. (Miles, 1980, p. 63)

The size of an organization also plays an important role in determining the speed at which information can be collected manually and the amount of effort required to collect that information. In cases where the nature of other organizational characteristics by themselves do not justify a higher level of office automation, the size constraint of larger organizations in regard to the timely collection of information and efficient use of finite

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management resources may justify higher levels of office automation.

In regard to office automation strategies, a low level of office automation is optimal for organizations with less than 50 employees, and a high level of office automation is optimal for large sized organizations with more than 1000 employees.

2. Structure

A major factor in the success of organizations is their structure. It gives individuals in the organization the ability to specialize using an organization's structure to assign tasks in support of a single objective, thereby completing in groups, those objectives which are too complex to be performed on an individual basis. Specialization also allows complex organizational objectives to be completed more efficiently than could be done on an individual basis. (Miles, 1980, p. 51)

Structure is the design by which organizations are subdivided; it also outlines the lines of authority and lines of communication between divisions. The division and specialization aspects of an organization's structure determines how work is assigned, and how resources are allocated to those work assignments. (Chandler, 1981. p. 23)

The characteristic of structure has two basic metrics by which to measure it. The first metric is the

tallness measure of a structure, this relates to how many management levels exist in the organization. The second metric is a measure of how wide the organization is, this relates to how many separate units are identified within each management level.

The unique input into the office automation framework gained from the structure characteristic is the number of management layers in the structure of an organization. The remaining structure metric, the number of separate units in an organization, contains redundant information when compared to the size and task characteristic inputs into the framework, and therefore is not addressed here as part of the structure characteristic. (Miles, 1980, pp. 19-20)

In regard to office automation strategies, a low level of office automation is optimal for organizational structures with one level of management control, and a high level of office automation is optimal for organizations with five or more levels of management control. Organizations which have a organization structure that lies between the two extremes above would be best served by a mid level office automation strategy.

3. Task

The number of tasks performed by an organization is closely related to the number of individuals employed to complete those tasks. Therefore, to describe the task

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characteristic in this manner would make it redundant to the size characteristic described earlier.

A better description of the task characteristic, in relation to the informational needs of an organization, is found in depicting the degree of routineness involved in tasks.

Some tasks are accomplished using an extremely limited variety of inputs and are completed in a constant well defined manner. Under these circumstances there is little variety associated with the task and or its possible outcomes. Tasks completed under these circumstances are classified as routine tasks.

Other tasks are classified as nonroutine. In these instances there are no well established inputs or methods for completing the task, nor are there strictly defined outcomes or standards of success associated with the task. (Perrow, 1970, p. 75)

The organizational characteristic of task has two metrics by which to measure its routineness. The first metric is "task variability", a measure regarding "the number of exceptions encountered" in a task. The second metric of nonroutineness is "task coping difficulty", a measure of "the amount of search [effort] needed to find successful methods to adequately respond to task exceptions". (Perrow, 1970, pp. 70)

In regard to office automation strategies, a low level of office automation is optimal for organizations which operate using routine tasks, and a high level of office automation is optimal for organizations which operate using mostly nonroutine tasks. Organizations whose tasks are best described as semi-routine would be optimally served by a mid level office automation strategy.

4. Technology

Another major factor in the success of organizations is the technology it uses. Technology improves the organization's ability to complete a task more efficiently, when compared to the technology base line of accomplishing the same task using strictly hand tools/hand labor.

> The development and persistence of complex organizations is in part determined by the extent to which their members can (1) identify and understand the mix of technologies and tasks required to meet operative goals and (2) design and implement appropriate structures of control and coordination to meet these task requirements. (Miles, 1980, p. 51)

Technology is defined as "the science of the application of knowledge to practical purposes" (Gove, 1961, p. 2348). In the context of organizations, technology may be viewed as the application of knowledge to organizational tasks to facilitate the completion of these tasks with reduced expenditure of organizational resources.

The metric used to measure technology is the degree to which specialized knowledge is incorporated into the organization.

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In regard to office automation strategies, a low level of office automation is optimal for organizations using primarily unassisted hand tool/hand labor methods to accomplish tasks. A high level of office automation is optimal for organizations using state of the art methods or for those who are developing a method which in the future will become the state of the art method in their industries. Lastly, organizations which use established technologies and practices require a mid level of office automation.

5. Employee Skill

Skill variety is one of five core job dimensions used to describe job enrichment. It also has an impact on the amount of information an employee must have in order to complete his or her assigned tasks. The remaining four dimensions are either inputted into the office automation framework by another organizational characteristic or do not affect the informational needs of the organization and hence are not used as inputs into the framework. (Hackman, 1981, p.335)

Employees must attain certain skill levels in order to meet the skill variety portion of their job description. These employee skill levels can be measured by the length of time required to train employees to complete a certain task and by the aptitude requirements necessary to become proficient at that task. The notion of training is used broadly here to include on-the-job training and the

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employee's formal full-time education completed prior to his or her entry into the organization.

The concept of employees should be looked at from the perspective of the whole organizational payroll, and not narrowly restricted to just those individuals with primarily information handling job descriptions. The type of skills under consideration in determining skill variety levels include both technical and management skills required to complete assigned tasks.

In regard to office automation strategies, a low level of office automation is optimal for organizations which require a low variety of employee skills i.e. minimal reading and writing skills. A high level of office automation is optimal for organizations which require a high variety of specialized employee skills. Lastly, organizations which require a moderate amount of employee skills require a mid level of office automation.

6. Environment

Organizations thrive only when the environment and the organization mutually sustain each other. The organizational characteristic of environment encompasses all the factors which affect the organization but remain external to the organization.

For example, organizations take in revenue from the environment and release their outputs for sale into the environment. In more specific examples, the federal

government establishes regulations regarding the safety of the workplace which affect the organization, and in the other direction, the organization, through advertising, attempts to influence its environment.

The metric used to measure the environmental input into the office automation framework is the environment's rate of change. Organizations which operate under strict government control or who are predicted to remain operating in the same manner 10 years in the future are described as being in a stable environment. Organizations which operate in new industries where no set business practices or established customer base exist are considered to be operating in a fast changing environment. (Lawrence, 1981, p.167)

The rate at which an organization is subject to new environmental considerations is largely responsible for the rate of change of characteristics internal to the organization. Therefore, the environmental rate of change is also a good measure for the rate of change of the whole organization.

In regard to office automation strategies, a low level of office automation is optimal for organizations which operate in a stable environment. A high level of office automation is optimal for organizations which operate in a continually fast changing environment. Lastly, organizations which operate in slow to moderate changing environments require a mid level of office automation.

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7. Geographical Dispersion

The characteristic of geographical dispersion is independent of size or structure. It is the measure of how many different locations an organization has under its control and how far apart the two most mutually distant locations are.

The least geographically dispersed organization has only one location, therefore the distance measure does not apply in this case.

In regard to office automation strategies, a low level of office automation is optimal for organizations which occupy only a single site. A high level of office automation is optimal for organizations which occupy sites dispersed nationally or internationally, and a mid level of office automation is optimal for regionally dispersed organizations with less then seven locations.

B. THE THREE LEVELS OF OFFICE AUTOMATION

In order to include as large a segment of potential office automation users as possible, the concept of office automation will be viewed from three levels. These three levels are called low level, mid level, and high level office automation. The types of organizational control and the highest automated functions available at each level are illustrated in Table II. Within each level of Table II OA functions are internally ranked, however the intralevel

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ranking and interdependence is not as absolute as with the interlevel rankings.

The OA levels in Table II are interrelated in such a manner that functions associated with lower levels in table II must be in place to support higher level functions when higher level office automation functions are desired. This concept of implied lower level functionality is consistent throughout all three functional levels of office automation as noted in the equations below:

Operational Control Functions = $f(WP,TP)$

Management Control Functions = $f(WP,TP,SF,DBMS,DDS)$

Strategic Control Functions = $f(WP,TP,SF,DBMS,DDS,ES,DS)$

TABLE II.
LEVELS OF OFFICE AUTOMATION

LOW LEVEL--OPERATIONAL CONTROL FUNCTIONS

1. Word Processing (WP)

2. Transaction Processing (TP)

MID LEVEL--MANAGEMENT CONTROL FUNCTIONS

3. Spreadsheet Forecasting (SF)

4. Data Base Management System (DBMS)

5. Decision Support Systems (DDS)

HIGH LEVEL--STRATEGIC CONTROL FUNCTIONS

6. Expert Systems (ES)

7. Distributed Systems (DS)

An example of this inter-relationship between office automation levels is data base management systems; they require input data about the organization in order to produce management control information. This data capture function is completed by the transaction processing function at the low level of the office automation system.

In a similar manner, expert systems, at the strategic control level, requires the use of lower functions such as the decision support system for its operation, and in turn, the decision support system needs both the data base management system and the transaction processing functions to operate.

The opposite of this interrelationship is not true. Applications at lower levels of office automation do not need higher levels of office automation to process office information. Transaction processing and word processing can, and frequently do, operate independently of higher level office automation functions. Similarly, data base management systems functions at the management control level can operate without the benefit of expert system functions at the strategic control level of office automation.

C. CHOOSING A LEVEL OF OFFICE AUTOMATION

Due to the interrelationship between the levels of office automation noted in the previous section, office automation decision makers are left with choosing from one

of three office automation strategies. These three strategies correspond to the three levels of office automation noted in Table II.

The difficulty inherent in this choice stems from the fact that seven independent characteristics have been identified as affecting the informational needs of an organization. Therefore, seven characteristics affect the decision process regarding the correct matching of an organization's informational needs to the optimal level of office automation. At this point it appears a great deal of information must be taken in as inputs to the office automation selection framework before an optimal office automation strategy can be selected.

Table III lists these seven organizational characteristics along with the range of descriptive values each characteristic can take on. Ranges for characteristics listed in Table III are broken down into three regions with a short description of each region. These three descriptions are listed in the three columns marked "A", "B" and "C" of Table III.

Column "A" denotes a region of the characteristic range which indicates a low level of office automation is required for that characteristic. Whereas column "C" denotes a region at the opposite end of the range for an individual characteristic, this region indicates that a high level of office automation is required for this particular

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TABLE III.

ORGANIZATIONAL CHARACTERISTICS

CHARACTERISTIC	COLUMN "A"	COLUMN "B"	COLUMN "C"
SIZE	LESS THAN 50 EMPLOYEES	50 TO 100 EMPLOYEES	MORE THAN 100 EMPLOYEES
STRUCTURE	ONE LAYER	2, 3, OR 4 LAYERS	5 OR MORE LAYERS
GEOGRAPHICAL DISPERSION	SINGLE SITE	REGIONAL	GLOBAL
TASK	ROUTINE	SEMI-ROUTINE	NON-ROUTINE
TECHNOLOGY	HAND LABOR	ESTABLISHED TECHNOLOGY	STATE OF THE ART
ENVIRONMENT	STABLE	SLOW CHANGING	FAST CHANGING
EMPLOYEE SKILLS	LOW VARIETY	MEDIUM VARIETY	HIGH VARIETY

characteristic. Column "B" denotes the mid region in the range of a characteristic, a middle ground between the two extreme regions listed in columns "A" and "C" of Table III. Characteristics with values in the column "B" region indicate a mid level of office automation is required.

Splitting the range that organizational characteristics can take on into three regions and then limiting the value of the seven organizational characteristics to only one of these three regions, scales down the problem of determining the appropriate level of office automation. Instead of accepting as inputs into the office analysis framework an infinite number of organizational characteristic combinations, only 2187 (three to the seven power) combinations exist when framework input data is limited to the seven characteristics broken down into three value regions.

Ideally, a mapping of all 2187 combinations to specific levels of office automation would be indicated. However to keep the framework tractable, another matching strategy will be presented here. Actual mapping of the individual 2187 combinations to a particular office automation strategy is left as follow-on work to this thesis.

The values for the seven informational characteristics must be combined into one measure which the office automation decision maker can use to determine the level of automation appropriate for a particular organization. This

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combining activity is accomplished mathematically using the following formula:

OA coefficient = (A * .14) + (B * .79) + (C * 1.43)

Where the "*" symbol indicates the multiplication of the two numbers within the parentheses. The variable A in the above equals the number of characteristics in the organization which can be described by the values in column "A" of Table III. Similar definitions for the variables B and C in the above formula can be related to the appropriate columns in Table III. In all cases, the sum of variables "A", "B" and "C" must equal seven.

It was decided that for convenience of usage the range of valid office automation coefficients would extend from one to ten. Designing the OA coefficient equation to this output range meant that an organization in which all seven characteristics could be described by column "A" values would be given an OA coefficient of one. Dividing one by seven yields approximately .14; therefore, each Column "A" characteristic would add .14 to the total OA coefficient.

Likewise, an organization in which all seven characteristics could be described by column "C" values would be given an OA coefficient of ten. Dividing ten by seven yields approximately 1.43; therefore, each Column "C" characteristic would add 1.43 to the total OA coefficient.

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The midway point on the OA coefficient scale is 5.5, therefore an organization in which all seven characteristics could be described by column "B" values would be given an OA coefficient of 5.5. Dividing 5.5 by seven yields approximately .79, therefore, each Column "B" characteristic would add .79 to the total OA coefficient.

The three explanations above do not cover the remaining 2184 combinations of organizational characteristics possible with seven characteristics constrained to three values each, but the OA coefficient formula is applicable to all 2187 combinations of organizational characteristics possible. Any combination of A, B and C, which describe the values of the seven characteristics for a specific organization, can be calculated to determine that organization's OA coefficient.

The relationship between any OA coefficient determined from the formula above and the correct level of office automation is given in Table IV.

The break point in Table IV between the operational level and the management level represents the half way point between 1 and 5.5, the "perfect" operational OA score and the "perfect" management OA score respectively. Likewise, the break point in Table IV between the management level and the strategic level represents the half way point between 5.5 and 10, the "perfect" operational OA score and the "perfect" management OA score respectively.

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TABLE IV.

OFFICE AUTOMATION LEVEL DETERMINATION

OA Coefficient Range	Office Automation Level
Less Than 3.25	LOW LEVEL - Operational Control
3.25 To 7.75	MID LEVEL - Management Control
Greater Than 7.75	HIGH LEVEL - Strategic Control

OA coefficients which border on transition points in Table IV should be reviewed to determine if any of the seven informational characteristics extend out of the bounds of the tri-level choices. That is, does a characteristic measure smaller than the column "A" descriptor or larger than the column "C" descriptor? In this case the required *office automation level may be decreased to a lower level* when one or more values of organizational characteristics are smaller then the column "A" descriptor. Similarly the office automation level may be increased to a higher level when one or more values of organizational characteristics are larger then the column "C" descriptor.

In rare cases this out-of-bounds situation may occur to an extreme. In the opinion of the person doing the OA determination one characteristic may appear to warrant the organization a different level of office automation from the level indicated by the OA coefficient formula. Office automation decision makers are warned not to disregard or

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weigh lightly the OA level determined using the OA coefficient formula above.

As an alternative to the outright dismissal of the OA coefficient determination, the reader in redirected to table II. In the table the seven office automation functions are listed in rank order from the lowest OA level to through to the highest OA level. Although the OA coefficient is not as strong a indicator of which specific functions a particular organization is best suited to within an OA level; it could in border line cases, indicate that only the lowest numbered function in the higher of the two OA strategies levels should be considered. Or a phased approach may be indicated. Organizations could install an OA system to meet the requirements of the lower level OA strategy and later expand to meet the requirements of the higher level OA strategy.

D. AN ILLUSTRATION OF THE OA FRAMEWORK

Assume an office automation decision maker is faced with the task of determining the correct level of office automation for an organization with the following characteristics:

- Size   350 Employees
- Structure   More Than Five Layers
- Dispersion   Gobal
- Task   Routine
- Technology   Established Technology
- Environment   Fast changing
- Employee Skills   Low Variety

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This set of organizational characteristics will yield two "A" values, two "B" values and three "C" values as shown in Table V.

TABLE V.

EXAMPLE OF INPUTS INTO THE OA EQUATION

CHARACTERISTIC	COLUMN "A"	COLUMN "B"	COLUMN "C"
Size		X	
Structure			X
Dispersion			X
Task	X		
Technology		X	
Environment			X
Employee Skills	X		
TOTAL	2	2	3

The OA coefficient formula for this organization looks like the following:

OA Coefficient = (2 * .14) + (2 * .79) + (3 * 1.43)

The OA coefficient for this organization is calculated to be 6.15, therefore referring to Table IV, the framework states the optimal office automation strategy is mid level office automation, the management control level. This organization should incorporate an OA strategy which includes, in an integrated fashion, the following OA functions; word processing, transaction processing, spreadsheet forecasting, data base management systems, and decision support systems.

Execution of the framework by this organization resulted in a clear OA direction and a specific end point,

both of which were lacking prior to the use of the Office Automation Framework. Now the organization can design an optimal office automation system. Whereas without the use of the Office Automation Framework, an office automation attempt could have resulted in either a slowing evolving set of semi-compatible OA upgrades or in the purchase of a grossly oversized OA system which would have overtaxed the resources and hence the profitability of the organization.

E.   RESULTS GAINED THROUGH THE USE OF THE OA FRAMEWORK

Office managers using the Office Automation Framework will avoid the pit falls suffered by office managers who attempt to design an OA system without first completing this extremely important step.

The OA Framework provides an organization with a method of bounding the size of their OA effort by producing a functional end point which directs the organization in a clear manner. A follow-on systems analysis of the organization can now be focused on only those tasks currently done manually which have OA corollaries identified by the framework as being appropriate for the organization.

As an additional benefit, an organization using the OA framework is spared the cost and frustration of incrementally expanding and retrofitting their OA system to meet originally unconsidered requirements which were later identified as critical to the organization's conversion to automated methods.

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Conversely, an organization using the framework is also spared the high cost of purchasing, installing and maintaining an OA system which is in excess of their needs. Through the purchase of an optimal OA system the organization receives the best cost/benefit return from their conversion from manual to automated office procedures. As a result the organization's competitive stature in relationship to other organizations within the same industry, and other organizations in general, is greatly improved.

One of the most important benefits of the Office Automation Framework lies in its ability to provide an organization with an integrated approach to automating manual functions. A known OA strategy can be applied from the original systems analysis through to the final determination of which OA vendor and OA system configuration is optimal for the organization. The framework provides an environment which allows office managers the opportunity to fully investigate the interrelationships between seemingly separate tasks which have been identified as candidates for automation. This investigation of the organization's task interaction yields the maximum synergistic benefit from the installed OA system.

Another major contribution of the Office Automation Framework is its ability to draw together an office manager and OA professionals into a structured environment that

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quickly yields an optimal OA strategy for the organization. The execution of the Framework in a quick and straight forward manner, as demonstrated earlier, produces an OA strategy that can be consistently followed from the original systems analysis of the organization, as discussed in chapters two and three of this thesis, right through to the equipment selection and user training noted in Appendices A and B.

Office Managers with extremely limited OA familiarity can, by examining seven characteristics of an organization, determine the optimal OA strategy for that organization via the Office Automation Framework. Inputs to the Framework are common organizational characteristics expressed in a management context familiar to office managers. This allows non OA professions, like office managers, to confidently choose the correct office automation strategy for their organization and therefore bound the size of the OA effort appropriate for their organization.

APPENDIX A.

OA IMPLEMENTATION GUIDELINES

A. TRANSITION TO OFFICE AUTOMATION

Regardless of what other actions an office manager takes in connection with the conversion of his office from paper to automated systems, the way he chooses to implement his new system has the most effect on the success of the whole endeavor. A good implementation strategy can reap substantial rewards from an office automation system which is somewhat sub-optimal for a particular office environment.

OA implementation is the process of bringing together people, equipment, and procedures to form a smooth running unit. Of these three, the proper integration of the people element, the office staff, into the picture is most critical to the success of the OA implementation. (Chafin, 1982, pp. 86)

A great deal has been written in the OA literature regarding how the office staff should be introduced to the concept of working with automated systems. The two examples below are representative of the topic.

> The importance of addressing the concerns of the people in the office cannot be over emphasized. The introduction of automated systems and related new work methods represents a major change in the office. Office workers will have natural concerns about health and safety, privacy, job security, job content, and a host of other issues. Uncertainty is a breeding ground for resistance. (Hammer, 1982, pp. 251)

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When a company undertakes an office automation effort, the question of job security soon crosses the minds of most employees. Unless that question is answered, lack of cooperation, tacit undermining, a talent flight, and other undesirable results may occur. Senior management's information strategy should include written assurance from the chief executive that office automation will not result in loss of jobs. (Barcomb, 1981, pp. 21)

People are the biggest asset in any office, or in any organization. A loss of this valuable asset in an attempt to make it more productive and hence more valuable is an ironic but all too likely event when OA systems are poorly implemented.

1. Dealing with OA Fears

A successful implementation strategy is based on two major principles. The first addresses the removal of barriers to office automation. The greatest of these barriers is fear, particularly fear of change and fear of job loss in connection with the office automation effort.

a. Fear of Personnel Reductions

A prime motivating factor for automating office activities is the reduction of personnel costs, one of the largest costs an office manager is faced with. This rational, however, is short sighted. A stated management policy of no personnel cuts due to automation, along with support for the argument that the same number of individuals are more productive using an OA system, can effectively counter a great deal of implementation resistance on the part of the office staff. In this manner, through increased

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productivity, the cost effectiveness of the OA system can still be maintained without the negative connotation of staff reductions.

Even members of the staff whose job security is assured would be affected by the personnel reorganization which results from personnel cuts. This reorganization would be disruptive to the established communication paths which are vital to the smooth and efficient operation of the organization. The reorganization itself would also add additional stress to an already stressful changing office environment.

Managers, who prior to automation did not use a typewriter are less likely to directly use many of the OA system's functions, particularly tasks which place a heavy emphasis on information input into the OA system, therefore clerical help will still be part of the office staff in a fully automated office. (Oleatt, 1985, pp. 7) All the above factors tend to negatively bias personnel reductions as a cost justification measure for OA systems.

b. Fear of Change

User resistance is also rooted in the fear of change.

> The first hurdle for new office system users is the feeling of fear and strangeness they have about the new machine....But, you have to overcome this fear or the user will simply not be in the proper mood for the user training phases of the OA implementation. (Henderson, 1982, pp. 730)

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Members of an office staff, like most people, are likely to resist change either actively or passively. This fear of change can be overcome by involving the staff in the selection and implementation of the new office automation system. "Informing them of the OA goals [for *their office*], soliciting their contributions, and reassuring them that their concerns will be addressed" should make great strides toward overcoming the fear that is associated with a change to automated methods. "Appropriate corporate policies should be established and articulated by senior management" to ensure that staff input has credibility in the formulation of the office's automation strategy. (Hammer, 1982, pp. 251)

2. OA User Incentives

The second major principle in a successful implementation strategy concerns the creation of incentives for using automated office systems. An office staff will be reluctant to change their work habits unless it is *demonstrated that this change will be in their best* interest. Therefore, the choice of OA applications introduced during system implementation should benefit both the organization and the users who must change their methods of operation to accommodate the new system. (Meyer, 1983, pp. 64) "Before you start teaching in earnest, give the user small but tangible successes. This helps users get over feelings of fear about the usefulness of the new OA

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system." (Henderson, 1982, pp. 731) Early user success will reinforce a positive attitude toward the OA system and will build momentum for more automated procedures in the follow-on stages of the OA implementation. (Meyer, 1983, pp. 64)

B. USER REJECTION OF NEW OA SYSTEMS

Conversely, OA implementation will suffer from user rejection when, from a users' perspective, the OA system is difficult to operate, and users still have access to alternate manual methods of completing their tasks. When rejection occurs, it is likely that the users had little or no input into the automation process, and the human factors of implementing the OA system were largely ignored by the system planners. (Chafin, 1982, pp. 86)

C. BENEFITS OF HIGH QUALITY USER TRAINING

The user training package that comes with an office system can help make or break the system...success of an office system depends almost entirely on how its users view it....Users of an office system will depend more on their first impressions about the system than users of systems designed for other user types, like application programers. If the office system doesn't seem useful after users try it for a short period of time (measured in hours), then they are not going to dig through the system's intricacies to figure it out. (Henderson, 1982, pp. 729)

One of the greatest aids in overcoming user resistance to office automation is through a training program designed to match the needs of new system users to the particular system being implemented. "This reinforces the idea that this machinery was installed to help the office staff do the

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job better and easier." (Lipoma, 1982, pp. 723) A high quality long-term training program smooths the transition between manual and automated procedures in the office environment. This program, along with reaping the benefits of reducing user fear, can become the prime vehicle for modifying the orientation of the office staff toward accepting automated procedures as common place and ordinary. The follow-on step to this reorientation then becomes making the full-time use of the OA system the new standard method of accomplishing various office tasks.

A quality training program is also the most visible sign of upper management concern for the office staff. From the user perspective, the program shows that they, the office staff, are as important as the "machines" in the new office concept being developed in their work place.

D. DEALING WITH TECHNOSTRESS

Craig Brod coins the term "technostress" to describe the emotional stress induced by the introduction of new technology. (Brod, 1984, pp. 28) Technostress has a very negative effect on the productivity of people who use OA systems. Common indicators of technostress are very slow learning curve improvements, high error rates, and blocked communication channels within the office structure (Brod, 1984, pp. 47). Brod suggests overcoming technostress using a strategy which divides adaptation to computers into three phases called orientation, operations and mastery.

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1. Orientation

The first phase is called orientation. Orientation begins three months before the automated system is placed into operation. During this phase system implementors meet with the office staff to explain the OA system and its intended impact on the office. Orientation may include placing the OA equipment in the office and making it available for viewing and experimentation. Meetings with future OA users during this phase should insure that the users have an accurate concept of what the system can do and what is expected of the users when the system goes into operation. It is particularly important for system implementors to address excessively negative or positive expectations on the part of potential users and to resolve issues users have regarding the conversion to automated methods. (Brod, 1984, pp. 46)

2. Operations

The second phase of the adaptation is called operations; it begins when the office staff actually starts using the OA system and starts developing a dependence on the system to complete various office tasks. During this phase system implementors can reduce stress by "making sure the office staff understands how the automated system fits into the office as a whole." (Brod, 1984, pp. 46) Other stress reducing activities include developing, in conjunction with the users, OA standards of control and

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standards for OA user performance. These standards can keep an organization from raising the work standards for people up to the level of "perfection, accuracy and speed to which computers have made managers accustomed". A sharp distinction between what is expected from the OA equipment and what is expected from the OA users should always be maintained. (Oleatt, 1984, pp. 9)

Another stress reduction method applicable to this phase consists of reducing staff workloads during the transition to automated procedures, this gives users the learning time necessary to gain the new skills required to effectively operate the OA system. "Establishing channels of communication to handle user frustrations," and promoting a "buddy system" in which advanced users can help less advanced users, are also two very important methods to reduce the stress associated with the operation of OA systems. (Brod, 1984, pp. 46-7)

3. Mastery

The last phase Brod describes in the adaptation process is called Mastery. Mastery "exists when skills to use the machine have been mastered and knowledge is present to expand computer application." During this phase the office staff is encouraged to "upgrade their OA skills" and "suggest new applications to improve productivity". Establishing user feedback loops regarding standards for OA system outputs and rewarding users for skills they have

learned are also suitable methods for stress relief in the mastery phase. (Brod, 1984, pp. 47)

Adding too much emphasis to cost controls and immediate productivity improvements during the implementation and early operation phases can stifle the enthusiasm and interest new users have regarding their OA system, and in the process managers can end up actively discouraging these users. Office managers should insure that the people and equipment work well together before they focus on reaping the productivity benefits of a structured and streamlined OA system. After promulgating structured OA procedures managers can still maintain user interest and improve productivity by asking users for suggestions regarding how these OA procedures can be changed to reduce costs and increase the performance of the business. (Strauss, 1983, pp. 26)

E. EQUIPMENT SELECTION BEFORE IMPLEMENTATION

Although the method used to implement an OA system into an office environment is very important, no realistic transition to an OA system can occur before an overall OA strategy is selected. Selection of an appropriate OA strategy for a particular organization is thrust of this thesis and is discussed at length in the main body of the thesis.

APPENDIX B.   NON-SYSTEMS ANALYSIS CONCERNS

This appendix covers considerations which do not fall strictly within the bounds of the systems analyses as discussed in this thesis but are none the less important to office managers reviewing potential OA systems.

These considerations are divided into two groups called system tests and physical factors. The following seven systems tests should be conducted on OA systems which have been identified for possible use by the organization by the reference framework and a suitable follow-on system analysis.

A.   SYSTEMS TESTS

1.   Procedure Test

Determine if exactly following the procedures in the OA system manual yields the proper results. Does the OA system do all things promised and do all the features of the OA system work to the user's satisfaction? (Senn, 1984, pp.539)

2.   Performance Time Test

Measure the response time of OA systems operating at expected activity levels and in overload conditions (Senn, 1984, pp.539). If a manager plans on his staff being able to answer customer inquiries during the same telephone

conversation they are received, then the OA system under consideration must meet that performance time criteria.

3.   Storage Test

The OA system must have enough storage capacity to keep all working data on file. (Senn, 1984, pp.539)   At some point older data will be archived to tapes or floppy disks for long term storage.   As a guideline for determining storage needs, "some 35 percent of all filed papers are never retrieved; 90 to 95 percent are never accessed after the first year."   (Barcomb, 1981, pp. 104)

4.   Peak Load Test

An effective OA system must be able to process the volume of activities that occur when all terminals are operating at peak processing capacity and the originally configured OA system should still have reserve capacity for future expansion needs. (Senn, 1984, pp.539)

5.   Recovery Test

Determine if users can restart the OA system after a failure has occurred, and determine the maximum extent to which data can be irretrievably lost.   Also determine how long it takes an OA system to return to full functionality after a failure occurs. (Senn, 1984, pp.539)

6.   Human Factors Test

Can users use the OA system throughout a complete work day without undo fatigue? (Senn, 1984, pp.539)

7. System Expansion Test

Both stand-alone single-user systems and clustered systems should be evaluated to determine their expansion capacities in terms of more work stations, more data storage and more applications. (Senn, 1984, pp.539)

B. PHYSICAL FACTORS

Prior to installing a particular OA system which satisfies the systems tests noted above certain physical factors should be considered to ensure proper operation of the OA system.

1. Electrical Power

Many OA systems require dedicated circuit breakers and power line conditioning equipment to maintain the desired level of reliability. In geographical areas where electrical power does not meet OA vendor requirements uninterruptable power supplies must be installed between the building electrical service point and the OA system.

2. Grounding Requirements

OA equipment must be properly grounded for safety reasons and to ensure proper operation. Directions for grounding terminals to each other and to the electrical ground of the building should be followed without deviation.

3. Cooling Load

OA systems like most large pieces of electronic equipment give off considerable amounts of waste heat. This

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coupled with a low tolerance for high temperatures common with computer equipment creates a potential problem for OA installations which do not plan for the additional cooling requirements needed to counter the increased waste heat produced.

4.   Fire Protection

Halon systems are the preferred method of providing fire protection for rooms dedicated to housing OA systems, the second most preferred method is carbon dioxide systems. The use of overhead sprinklers will cause the OA system to be non-operational for an extensive period of time which would be extremely unfortunate if the "fire" is later determined to be a false alarm.

5.   Space

OA systems occupy space. The work station portion of OA systems are normally located on the users desk or at a dedicated table nearby. To derive maximum benefit from the OA system these new work stations must be integrated into the user's personal work environment complimenting non-OA activities.

Furthermore, mass storage devices or central processing units may require a large portion of a room or a completely dedicated room for fire protection and security reasons.

6.   Cable Routing

An OA system with multiple work stations will require the routing of cables between the various pieces of equipment that comprise the system. Route planning should consider abrasion damage to cables, fire codes, and possible future expansion before determining the final cable routing configuration.

7.   Security

Information stored in OA systems is one of the most valuable assets an organization possesses. Its loss or compromise to competitors can be a major financial loss. Security measures to prevent unauthorized access to the information should be in place to protect the information prior to declaring an OA system operational. Addressing the topic of data security should not wait until after an instance of data compromise or loss but should be addressed when the OA system is originally designed.

OA system installation planning should also consider physical security of the equipment itself. OA systems are themselves high value items. Stand alone micro computers in particular suffer from high theft rates when situated in uncontrolled office settings. (Senn, 1984, pp.539)

C.   IMPLEMENTATION AND OPERATIONAL COSTS

When radically different methods of completing certain tasks are undertaken, cost estimates regarding those new methods are difficult to ascertain.   A break down of cost areas incurred when implementing and operating OA systems are listed in table VI to help office managers estimate the reoccurring and non-reoccurring costs associated with OA systems.

TABLE VI.

OFFICE AUTOMATION COSTS
(Kroenke,1983,pp.36)

IMPLEMENTATION COSTS

      System Analysis And System Design
      Facilities Preparation
      Hardware Costs
      Software Costs
      System Acceptance Testing
      Documentation
      One-Time Training
      Data Conversion
      Data Capture

OPERATING COSTS

      User Personnel
      DP Personnel
      Communications Expense
      Electrical Power
      Paper Costs
      Recurring Training
      Backup
      Recovery
      Hardware Maintenance
      Software Maintenance
      Documentation Updates

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